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Simplified Ethernet Comms Overcomes Skills Shortage

In the constant drive to improve productivity, industrial communications will play an increasingly important role in manufacturing. Newer technologies such as Industrial Ethernet are growing in popularity, but who will maintain the networks after the installers leave? Steve Jones of the CC-Link Partner Association reviews the situation.

Skilled control engineers are an increasingly endangered species in many parts of Europe, so the technology of communications networks and control technologies must become simpler so that systems can be designed, installed, maintained and adapted by engineers whose skills base may not be focused on communications networks.

As industrial control and automation systems developed, control engineers moved from centralised to distributed intelligence to avoid the problems associated with a failure of the central controller bringing the whole plant to a standstill. To connect these distributed devices, control networks based on proprietary networks from the controller manufacturer were generally used. In addition to providing more robust control systems, economic savings were also delivered.

In a networked system devices are connected via a single network cable rather than individually wired back to the controller. This allows reductions in cabling and facilitates commissioning and maintenance, saving both time and money.

There were other benefits of networked control systems and it soon became apparent that using open networks allowed the connection of diverse third party devices. More recently end-users have seen the appeal of standard Ethernet in industrial applications as a way of communicating shop floor data to the information system.

However, unlike the popular automation networks such as Profibus and CC-Link, standard Ethernet will not deliver the deterministic (predictable) response times needed for modern complex manufacturing. Many of the new generation of Industrial Ethernets provide determinism, but at the cost of unwanted complexity. This complexity adversely affects down time, maintenance and making changes to the network configuration.

In developing its Industrial Ethernet version of CC-Link, the CC-Link Partner Association (CLPA) considered the knowledge it had accumulated over the past ten years. The outcome was CC-Link IE, the Non-Stop Open Network (NSON) that exceeded the performance of all other networks by offering Gigabit performance. However, although speed is important, it is the ease of use of CC-Link IE that makes it special.

In addition to high throughput of control and communication data, CLPA designed CC-Link IE to enable plant engineers with little or no knowledge of Ethernet or network configuration to maintain the system.

Simple configuration and network diagnosis without being aware of the Ethernet enables the reduction of total cost from introduction through to operation and maintenance. Additional stations can be freely connected to an existing hub or station, with no specific CC-Link IE protocol knowledge being required.

Routing communications through the CC-Link IE network is accomplished simply by specifying the station number and network number from which the data are obtained. This allows control programs to be created as if the entire system is a single network and ensures that determinism is always maintained.

Maintenance and reconfiguration of the control system are much easier because individual devices can simply be removed from or added to a CC-Link IE network. There is no need to shut the network down to replace a device, just a simple hot swap out and replace. In other words a non-stop open network.

CC-Link IE simplifies the implementation and adaption of the Industrial Ethernet network and enables the universal techniques of Ethernet, its tools and equipment to be used. Automated troubleshooting, flexible topologies, determinism and resistance to electrical noise have also been integrated into the CC-Link network.

Suitable TCP/IP devices such as RFID readers, bar code scanners and similar devices are simply connected via an Ethernet adaptor.

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Ten years of success

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Reliable monitoring systems for biogas-fuelled cogeneration plants

Today a growing number of farmers are generating power from the biomass produced by their farms. However, the investment in biogas-fuelled cogeneration plants can only pay off if the systems can be depended on to run reliably for years.

CC-Link helps keep America manufacturing

An American manufacturer of high quality precision machined parts has invested in new control systems rather than transfer its production to low wage countries. It is reaping the benefits of having recreated a state of the art production facility with booming exports to Europe and Asia.

See us at the SPS/Drives show in November

Located in Hall 6, booth 435, the CLPA presence at the SPS/IPC/Drives fair in Nuremberg, Germany (23-25 November 2010) has been extended to 60 sq M.

Ten years of success

November 2010 represents a milestone for the CC-Link Partner Association as it celebrates the 10th anniversary of its formation to promote CC-link as an open network.

Over the last decade CC-Link has become globally accepted and recognised as a leading open network and more recently recognised under its new identity of 'The Non-Stop Open Network™'.

The CLPA Board of Directors has recently been strengthened by the addition of two US based corporations: 3M's Electronic and Communications Division and imaging specialist Cognex Corporation.

Originated by leading global automation supplier Mitsubishi Electric, CC-Link is the de-facto standard for automation networks in Asia. CC-Link is unrivalled for global manufacturers looking to implement a single networking standard across multiple sites in multiple regions. As a result it is the network of choice for many of the world's best known multi-national industrial corporations.

Introduced originally as a factory automation network, CC-Link is now accepted in a wide variety of applications including: automotive, commercial industries, and building automation as well as printing, textile, petroleum, steel, rubber, food and drink, tobacco, water treatment and a host of other industries.

CC-Link's globally installed base has risen to over seven million nodes, with annual growth of around one million nodes per year. CLPA membership now exceeds 1300 partner companies, and over 200 of these have developed compatible products, giving users access to well over 1000 conformance tested devices.

Integrating CC-Link into products is one of the best ways to exploit business growth opportunities in the Asian region. CLPA Europe actively assists its manufacturing and OEM members to enter these markets through its 'Gateway to Asia' (G2A) programme. In addition to assisting with the integration of CC-Link network technology into products and systems, CLPA Europe can provide marketing support via CLPA branches throughout the World.

In terms of global standardization CC-Link has attained international standards including SEMI E54.12, ISO 15745-5, IEC61158 and IEC61784. In addition, many national standards have also been attained including China, Korea and Taiwan.

CLPA has marketing and support offices worldwide. The European offices are in Germany and UK, and a new office is planned for Russia in 2011. Regional support is provided by CC-Link Promotion Partners in the Netherlands, Turkey and the Ukraine.

Fast data communications with CC-Link for biogas-fuelled cogeneration plants

Today a growing number of farmers are generating power from the biomass produced by their farms. However, the investment in biogas-fuelled cogeneration plants can only pay off if the systems can be depended on to run reliably for years. In turn, this is only possible with equally reliable automation and network systems that are also easy to operate. German power plant specialists Dreyer & Bosse produce extremely reliable autonomous co-generation units that utilise CC-Link open fieldbus network technology for data communications and crucial safety and monitoring functions.

Reliable and economical

Dreyer & Bosse Kraftwerke GmbH in Gorleben specialises in the construction and automation of cogeneration units and the control systems for the fermenters that generate the biogas fuel from bio-mass. The company engineers, develops and builds custom-designed cogeneration units in which the generators are driven by biogas or dual-fuel diesel/biogas engines. Everything is installed in a single container that is delivered ready for connection. Originally established in 1997 with a staff of three, the company now has over fifty employees and is one of Germany's leading manufacturers of cogeneration units, selling its products worldwide.

Modern control technology and the CC-Link (Control and Communication Link) fieldbus network ensure that Dreyer & Bosse's autonomous power plants are both reliable and economical to operate. The following outlines a typical D&B system, a 500-kilowatt cogeneration unit installed on farm with 70 hectares (173 acres) of arable land and 5 hectares (12.5 acres) of pastures in the Lüchow-Dannenberg district of the German state of Lower Saxony.

The entire system is controlled by powerful compact controllers from Mitsubishi Electric. The main controller is a MELSEC FX3U programmable logic controller (PLC), which communicates with the system's various automation components via a CC-Link master module and standard serial ports. Integrated instructions and drivers for Mitsubishi automation components eliminate the need for complex and time-consuming controller programming.

A simple bus replaces complex individual wiring

The CC-Link fieldbus network and the simple installation of the system components enabled the Dreyer & Bosse engineers to significantly reduce both material costs and wiring overheads. Resistance to electromagnetic interference (EMI) was also a major factor for the choice of this technology. Unlike other fieldbus systems, the conformance tests for CC-Link compatible devices include comprehensive EMI testing that is far more rigorous than the standard European EMC tests, making it ideal for this type of application.

CC-Link's high network data transfer rates of up to 10 megabits per second and its deterministic performance ensure a continuous update cycle speed of just 3.9 milliseconds for all data. The network is configured with simple menus in the PLC programming software package conforming to the IEC 61131-3 standard. No special device configuration files need to be created to set up the network: the parameters are read directly from the CC-Link master module by the PLC program using a standard function block.

The PLC's processing speed matches the network transfer rates, making it possible to achieve the high levels of safety and reliability required for cogeneration plants, for example for feeding the generated power into the public grid.

Remote monitoring for cogeneration plants

Reliable operation and monitoring are also crucial for trouble-free operation. The main ACB is also connected directly to the CC-Link network, and all the electrical parameters of the low-voltage network can be displayed in detail on the system's graphical HMI. If a circuit breaker trips, a message is triggered automatically and the operator sees detailed information from the activated trip relay via the CC-Link network. The last ten alarms and trip messages are also stored in an error buffer with timestamps for later analysis.

Remote maintenance and monitoring of important parameters via modem are also supported, further adding to the safety, reliability and user friendliness of the system. For example the owner can check the power being fed into the public grid remotely at any time.

Local farm operators have been so impressed by the performance of these biogas fuelled power generation systems that they are now investing another 1.5 million Euros in a gas processing plant. This plant will increase the quality of the biogas to bring it up to commercial natural gas standards, allowing it to be fed into the local public gas grid. In addition to this it will also be sold to a new biogas filling station at nearby petrol stations.

T&L Automatics reaps the benefits of integrated automation

In line with the growing trend for 'reshoring', an American manufacturer of high quality precision machined parts has invested in new control systems rather than transfer its production to low wage countries, and is reaping the benefits of having recreated a state of the art production facility with booming exports to Europe and Asia.

T&L Automatics Inc of Rochester, New York makes high quality precision machined parts having complex features and intricate details for the automotive, aerospace and defence industries. Aware of increasing competition from offshore producers, management decided to review the company's productivity with a view to improving efficiency, reducing losses and containing costs. T&L has been in operation for over 30 years and some of its production equipment was no longer efficient by modern standards.

The option of completely stripping out the plant and installing all-new equipment was seen as too expensive and disruptive. Off-shoring was considered, however it was realised that many of the machines were in good order, but the control systems were outdated and had become unreliable through age. T&L thought that if it could eliminate these problems then costs and productivity would improve significantly and there would be an increase in product quality. They called in solutions provider Unique Automation, from nearby Rochester, and decided to upgrade the indexing machines by replacing the problematic CNC controllers with state of the art alternatives - advanced PLCs and HMIs.

Significantly the hard-wired control system was also stripped out and replaced with a high speed CC-Link control network. CC-Link is an Open Source fieldbus that is configured as a single control loop, to which all switches and devices are directly connected. This contrasts with the original system, where each device was individually wired back to the central controller.

In fact, by using CC-Link's network architecture, over 8000m of wiring was eliminated per machine. Previously broken, loose and shorted wires alone were a significant source of problems and downtime. With so much less wiring, such failures were immediately reduced.

Additionally, diagnosing mechanical problems is far easier with the CC-Link networking, and adding new I/O points is much faster because they are simply using CC-Link to network each machining centre. Unique Automation employed a high performance Mitsubishi PLC with two CC-Link Master stations to control two independent CC-Link networks.

The first CC-Link network included four Mitsubishi CNC controllers to manage the seven machining stations within each centre. The CNCs work as local station devices and occupy four CC-Link network stations.

Three CNCs manage six machining stations with a total of 24 axes of control. The fourth CNC manages the seventh machining station with four axes of control. Therefore the first CC-Link network serves a total of 28 axes of movement. This network handles over 1000 I/O points for communicating status to four CNC controllers as well as transmitting commands to control other functions of the machine.

The second CC-Link network consists of 24 remote I/O modules to handle the various inputs and outputs on machining centre. This second network connects more than 600 inputs and outputs to manage the actions necessary to machine complex features and intricate part details.

Using the PLC and the two CC-Link Master stations, the control programme is able to read all inputs and outputs on the second CC-Link network; execute the control program (which consists of over 15,000 steps of ladder code) within the PLC; set all outputs, and communicate necessary information to the CNC on the first CC-Link network. With each CNC executing 7,500 steps of ladder code for a total of 30,000 total steps of code within the CNC controller setup, the total number of ladder steps exceeds 45,000. The total processing time for this entire control loop is approximately 7.3ms – a significant improvement over the previous system. In addition to the cost savings and increased productivity associated with the installation of the CC-Link network, quality of the machined parts has also vastly improved and downtime has been virtually eliminated.

3M supports CC-Link open networking technology

One of the world's leading technology firms, 3M Company, has joined the Board of Director Companies of the CC-Link Partner Association (CLPA), one of the world's leading open control networking organizations. 3M joins some of the most powerful companies in industrial electronics on the Board of CLPA, including Digital Electronics Company, IDEC, NEC, Mitsubishi Electric and Cognex. Chair of the Board is Takashi Sekiguchi, professor emeritus at Yokohama National University. With the other five Board members, 3M will leverage its strengths in the continued global promotion and popularisation of the CC-Link family of networks.

3M's participation is significant because of its preeminent position as a diversified technology company. It has considerable experience in the design and development of expert connectivity and wiring systems, and has designed and manufactures a range of CC-Link products including connectors and cables. As a regular member of CLPA for many years, 3M has helped to formulate CC-Link specifications through its involvement in technical/marketing and working groups. With a global business network spreading across 65 countries, 3M will improve the local availability of parts and is welcomed as a board member of CLPA in the 10th anniversary of its founding.

Since its establishment in 2000 to promote CC-Link network technology, CLPA has gained more than 1,300 partner companies of whom more than 60% are outside of Japan. Over seven million nodes of CC-Link compatible products have been installed worldwide, with more than 1000 certified CC-Link products manufactured by 220 companies.

FDT Group and CC-Link Announce Cooperation Agreement

The CC-Link Partner Association (CLPA) has signed a cooperation agreement with the FDT Group to promote the use of the FDT as an international standard. Under the agreement, CLPA will support the development of an annex of the protocol to support the CC-Link family of networks including its CC-Link IE Field Gigabit Industrial Ethernet.

CLPA's participation is significant because of its pre-eminence in the Asian markets and in November 2010, FDT will make a presentation to a selected audience of members, users and the press at the CLPA 10th anniversary celebrations in Tokyo.

FDT standardises the communication and configuration interface between all field devices and host systems. It provides a common environment for accessing the devices' most sophisticated features. Any device can be configured, operated, and maintained over the CC-Link networks through the standardized user interface, regardless of supplier or type.

Steve Jones, European General Manager of the CLPA says, "We find increasingly that users are demanding common tools to enable them to access and integrate intelligent field devices. Implementing the common environment provided by FDT provides this, but also gives us the potential to add new functionality for users of CC-Link networks."

Glenn Schulz, General Manager of the FDT Group states, " We are pleased to have formalised this excellent working relationship with CLPA. Their broad acceptance in the automation market place is a compliment to the core goals and objectives of the FDT standard."

New CC-Link compatible products

High performance RFID solutions from Balluff

Modern production and materials handling applications demand high performance contact free communications. With over twenty years experience in RFID, leading sensor specialist Balluff has introduced CC-Link network connectivity to its range of high performance BIS-M Series devices.

In conjunction with CC-Link, Balluff's BIS-M Series meets the demand for high speed, long distance data transfer, as well as:

- 100% data security
- Consistent error prevention
- Secure process control
- Reliable traceability
- Optimised production

HMS Industrial Networks Anybus CC-Link Drive Profile CompactCom

The Anybus-CompactCom Drive Profile CC-Link communication module provides instant CC-Link Drive Profile connectivity via the uniform Anybus-CompactCom host interface. Any device that supports this standard can take advantage of the features provided by the module, allowing seamless network integration regardless of network type. The module supports Drive operations according to the Inverter profile of CC-Link. When used in standard mode the module supports CC-Link version 1.1 but during initialisation can be configured for CC-Link version 2.0 functionality.

- Remote bus device
- Drive Profile operation according to the Inverter Profile
- Galvanically isolated bus electronics
- CC-Link parameter channel support according to the Inverter Profile
- Automatic CC-Link System Area handshaking

NXEB 100-NET netX network development & evaluation board

The NXEB100-NET provides a total of 6 different fieldbus interfaces (CC-Link, CAN, Profibus, AS-Interface, DeviceNet, and INTERBUS). Only one of these interfaces can be used at a time and the board must be configured appropriately in order to use a certain interface.

All elements of the board are powered by an onboard switching power supply, which can be operated by a wide range of simple (unregulated) standard power supplies from 9V to 24V output voltage. For software development, all NXEB100-NET come with a JTAG connector, allowing it to connect an appropriate debugger device.

- netX 100 with Master license
- 4 MByte 16-bit Flash
- 8 MByte 32-bit SDRAM
- Two Ethernet Ports with switch and hub functionality
- USB 1.1 device
- UART with RS232C-Interface
- JTAG Interface

The Non-Stop Open Network

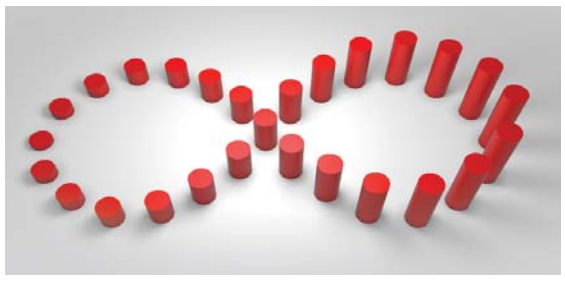
2011 will see a wider scope for CLPA as we start to promote the benefits of the CC-Link family to the users of open networks.

In selecting an industrial communication network, factors such as speed, ease of integration, and openness can be taken for granted with most major protocols. However, this is not true for network availability, and with increases in productivity and legislation, the information handled by the networks will become as important as the control function.

This is where CC-Link family of networks offer tangible benefits derived from a range of innovative technical features designed to keep the network functioning in situations that will cause most fieldbuses to stop. With features such as high noise immunity, 'floating network master', hot-swap capability and station bypass, CC-Link is unique in offering genuine 'non-stop' functionality.

Electrical noise (EMI) can cause transient problems which are difficult to identify. The causes may be due to poor wiring, earthing or radiated noise and can be a real problem for fieldbus users. Uniquely, part of the CC-Link conformance testing includes stringent EMI radiation and immunity tests, which mean certified products, are far more reliable in operation.

Another cause of lost production and/or data can be failure of the network master. With CC-Link's 'floating master' capability, an alternate controller on the network can immediately take over operation to maintain continuity with no interruptions.



Up to twenty six standby masters can be nominated and each can have a different programme to cater for different failures.

Network availability is also increased through CC-Link's hot-swap capability and station bypass. The hot-swap function means that stations can be removed from and returned to the network as required without causing any malfunctions. This simplifies maintenance or testing of stations with no risk of interrupting operation, and applies to both network masters and slaves.

Station bypass allows the network to be created in the network master but the actual hardware stations can be added later as required. These stations can be activated without stopping or resetting the network, saving lost production or additional software writing and commissioning time.

The 'Non-Stop" principle extends to development, installation and maintenance of the network as well. CC-Link needs no special station description files when configuring the network. This means that if a CC-Link device is replaced it is not necessary to find the appropriate configuration file or go into the network and update the system information.

Importance of SPS/IPC Drives fair grows

Located in Hall 6, booth 435, the CLPA presence at the SPS/IPC/Drives fair in Nuremberg, Germany (23-25 November 2010) has been extended to 60 sq M. The increase has been necessary to accommodate the additional partner products on display, and to promote several initiatives in support of its European members. Reflecting its strong growth, feature displays from partners Hilscher, HMS, Mitsubishi Electric and Weidmüller, as well as fifty other CC-Link compatible products from European, American and Asian partners will be on display.

At the fair, CLPA will continue developing its Gateway to Asia (G2A) promotion through which it encourages European makers to integrate CC-Link technologies into their products to help them maximise sales in the Asian Markets. This initiative is supported by the CLPA Marketing Task force which is currently identifying ways to help members sell more of their products into Asian and other markets.

European project leader John Browett says "This will be the first time we have been able to help our European partners operate in Asia more effectively and we see it as an important first step in expanding our mutual cooperation."

CLPA will also celebrate the 10th anniversary of its formation to manage and promote CC-Link as an open network. Since year 2000 the membership and range of compatible products have grown strongly, and new technologies have been introduced to reflect trends and changes in the market. In addition to the original CC-Link the Association now supports a safety version, a sensor and I/O level version and the latest CC-Link IE Gigabit Industrial Ethernet versions. The core operation and functionality of CC-Link is retained in these variants to ensure familiarity for users and simplify integration.

CLPA European members

3M Deutschland
ABB AS Robotics
ABB OY
Advanced Electrical Ltd
AGH University of Science and Technology
Akhnaton Ltd
APS Ltd
APV Products
ASKON
Atlas Copco Tools AB
ATYS-co
AutoCont Control Systems
Automatec Sp. Z o.o.
Automation Research Centre, University of Limerick
Balluff GmbH
Barwit Control Systems (MH) Ltd
Beckhoff Automation GmbH
Beijer Electronics AB
Belcom
Belden
Betech 100pt Ltd
Bihl+Wiedemann GmbH
BPX Electro Mechanical Ltd
CBI Electric
CNC CBKO SP. zo.0
Cognex
Contrinex AG
Control Techniques Drives Ltd
Cougar Automation Ltd
CSC Automation Ltd
Datalogic S.p.A.
Datasensor SPA
DDC Ltd
Deutschmann Automation GmbH & Co KG.
Eaton Electric Ltd
Econotec Industrie Automation AG
Elektronik-Systeme LAUER GmbH
Engineering-Service Ltd
Festo AG & Co. KG
Fuji Electric FA Europe GmbH
Gateweb GmbH
Geotek Elektrik Elektronik Otomasyon Ltd Sti
GEVA Elektronik Handelsgesellschaft mbH
Global Associates
GTS Asansör San. ve Tic. Ltd. ti. Mr
GTS Genel Teknik Sistemler Ltd. Sti.
Hengstler GmbH
Hilscher GmbH
HMS Industrial Networks AB
Hottinger Baldwin Messtechnik GmbH
Idec Electronics
Igus GmbH
Industrial Solutions Ltd
INEA d.o.o.
Institute of Automatic Control & Robotics, Warsaw University
K A Schmersal GmbH
Kiev Polytechnic Institute
Kisco Deutschland) GmbH
Kitron AS
Koning / Hartman
Krakow Universtiy of Technology
KUNBUS GmbH
L C Automation Ltd
Lemvigh Muller Industriel & Aytomation
Leoni Special Cables Friesoythe GmbH & Co.KG
Leuze Electronic GmbH + Co KG
Lütze Ltd
Manuel Jehkul
Medicion Y Control, S.A.
Meltrade Automatika Kft
MESCO Engineering GmbH
Mikrol
Mitsubishi Electric Europe
MPL Technma Sp. Z.o.o.
MPL Technology Sp z o. o.
National University of Food Technology
Newton Tesla (Electronic Drives) Ltd
Northern Design (Electronics) Ltd
Ogrody Podlaskie Kowalewsey sp.j.
Oliver IGD Ltd
OptionExist Limited
Oriental Motor (Europe) GmbH
Paktronic Engineering Co Ltd
Panasonic Electric Works Europe AG
Parker SSD Drives
Patelite Corporation
Pepperl & Fuchs GmbH
Pilz GmbH & Co.
Politechnika Czestochowska ITMiAP
Pro-face Europe BV
Pronar Sp. Z o. o.
Prosoft Technology
Rudolf Kleinser Schaltungsbau
Saftronics Limited
Schneider Electric SA
S C Johnson
Seacane Ltd
Severn Controls Ltd
SICK AG
Sirius Trading & Services SRL
Slavutich PPA
SMC European Technical Centre
Softing AG
Sotrinic Ps. Z.o.o.
SVS-Nevelin GmbH
Tambrands-Ukraine Ltd
Taurusprobiz Ltd
TC Ltd
Technical University of Liberec
Technikon ltd
The Silesian University of Technology Faculty of Mechanical Engineering
Trigla Ltd
U.I Lapp GmbH
UKRBIOTAL Ltd
Ukr-PAK Ltd
VAT Vakuum ventile AG
Veda-servis
Volev Firma
WAGO Kontakttechnik GmbH
Warsaw University of Technology Institute of Radioelectronics
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Westermo Data Communications Ltd
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